REMARKS

Original claims 1-4, 6-15, and 17- 38 remain in the case. Claims 5 and 16 have been cancelled. Claims 25-30 are allowed. Applicants wish to thank the Examiner for the allowance of claims 25-30.

The Amendments of Claims 1 and 6

Applicants have amended claim 1 by incorporating the limitation of claim 5 (now cancelled) which specified that the temperature of the 95 weight percent point is above about 730 degrees F. The amendment to claim 6 is intended to change the dependency of that claim from cancelled claim 5 to claim 1.

Accordingly, the amendments to claims 1 and 6 are proper and entry is respectfully requested.

The Rejection of Claims 1-15, 17-24, and 31-38 Under 35 USC 103(a)

Claims 1-15, 17-24 and 31-38 stand rejected under 35 U.S.C.103(a) as being obvious over U.S. Patent 5,378,348 (hereafter referred to as "Davis et al."). The Office Action argues that Davis et al. teaches a typical product slate which includes fractions boiling within the range of applicants' compositions. With the amendment of claim 1, the invention covered by the claims in Applicants' application may be distinguished from the cited reference and are patentable over it.

Applicants' Claimed Invention

Before discussing the Davis et al. reference, Applicants' wish to discuss in some depth the invention claimed in this application. A clear understanding of the invention and the structure of the claims in the case will be useful in

explaining why Applicants' invention may be distinguished from the cited art and is patentable over it.

Claims 1-15, 17-24, and 31-38 are directed to fuel compositions which are suitable for use in diesel and jet engines which display significantly lower toxicity than conventional fuels when contacted with the skin. While some of the compositions may be suitable for use as jet fuel, most of the fuel compositions are intended for use in diesel engines. In addition, the fuel compositions of the invention are novel in that the upper boiling point, i.e., end-point, falls above the boiling range of conventional diesel fuel. The end boiling point of diesel is usually given as somewhere in the range of about 680 degrees F. As will be discussed below, Davis et al. describes the end boiling point for his diesel fuel as 700 degrees F. All of the fuel compositions within the scope of amended claim 1 are defined as having their 95 weight percent point at 730 degrees F or higher. Preferred compositions have significantly higher 95 weight percent points. Note also that the most preferred of Applicants' fuel compositions have a 95 weight percent point of 850 degrees F or more. It must be remembered that the end boiling point of a hydrocarbon composition will be significantly higher than the 95 weight percent point. Conventional petroleum derived hydrocarbons with an end point above about 680-700 degrees F will have a viscosity and cloud point which is too high for use as a commercial diesel fuel. When used in a diesel engine, conventional fuels having an end point this high would also produce too much particulate matter in the engine exhaust. However, due to the unique properties of Fischer-Tropsch hydrocarbons, Applicants have found that diesel fuels having significantly higher boiling ranges may be prepared which are suitable for use in diesel engines engines.

Applicants have also found that there are two methods which may be used to lower the toxicity of the Fischer-Tropsch fuel compositions covered by the claims in this application. This accounts for the

differences in the temperatures of the 95% points given in claims 1, 31, and 35.

One method for lowering toxicity involves removing the hydrocarbon fraction boiling between about 400 and 650 degrees F (preferably the 500-600 degree fraction) which Applicants has found to be highly toxic. This gives some of compositions within the scope of Applicants' claims a bi-modal boiling profile (see Figure 2 in the application). In the absence of this toxic fraction, it is possible to lower the 95% point down to about 630 degrees F and still have a composition with very low toxicity. Claim 35 is directed only to compositions having a bi-modal boiling profile in which the highly toxic 400-650 degree F fraction has been reduced to less than 30 weight percent or less. Preferably the amount of this fraction present in the fuel is even lower, or more preferably, it is completely removed.

The second means for lowering the toxicity of the entire composition is by increasing the heavy ends by raising the 95% point. Applicants have found that the very high boiling material not only is less toxic than the 400-650 degree F fraction but it is able to neutralize the toxicity of this toxic fraction. Applicants discovered that a very low toxicity could be achieved even with the toxic fraction remaining in the fuel composition if the amount of high boiling material present is increased. By raising the 95% point to at least 730 degrees F (preferably higher) it was found to be unnecessary to remove the toxic fraction, and the compositions were still able to display significantly reduced toxicity. This is illustrated in Figure 3 of the application which graphs dermal toxicity vs. the mid boiling point (the 50 weight percent boiling point) of various fuel compositions. Note that the toxicity of the compositions increases up to a mid-point of about 650 degrees F. When the mid boiling point of the compositions exceeds about 650 degrees F, the toxicity of the compositions rapidly decreases. As illustrated in the graph, compositions having a mid boiling point of 800 degrees F displayed no detectable toxicity as compared to the sham despite the

presence of the 400-650 degree F fraction. While the mechanism of what is happening is not fully understood, it is obvious from the data that the presence of the heavy material is protecting the mice from the toxic effects of the 400-650 degree fraction. In this instance, it is not necessary for the composition to have a bi-modal boiling profile. The fuel composition may have a uni-modal profile as shown in Figure 1 of the application. However, in order to lower the toxicity in a fuel having a uni-modal boiling profile, the amount of heavy ends must be increased which necessitates raising the 95% point to at least 730 degrees F. This is covered in amended claim 1 of the application.

Applicants further point out that claim 31 is intended to functionally describe compositions having both the uni-modal and bi-modal profiles. When the 95% point is below about 730 degrees F, the compositions should have a bi-modal boiling profile in order to achieve the desired reduced toxicity, i.e., the toxic fraction must be reduced or removed. As the 95% point is raised above about 730 degrees F, lower toxicity may be achieved with compositions having either a bi-modal or uni-modal profile because the amount of beneficial heavy (high boiling) material in the composition is also increased.

A brief remark may be appropriate as to why Applicants elected to use the 95 weight percent point instead of the end-point as used in the Davis et al. reference. Since hydrocarbon mixtures, such as those obtained from Fischer-Tropsch synthesis and petroleum, contain a wide range of molecular weight hydrocarbons, the compositions will often contain small amounts of tails (minor amounts of high boiling hydrocarbons) which distort the boiling range distribution. Thus the 95 weight percent point is intended to eliminate the tails and give a more accurate definition of the boiling range distribution of the hydrocarbons. This means that the actual end-point of Applicants' compositions will be significantly higher than the 95 weight percent point because the hydrocarbon tails are by definition not included. Depending on the amount of tail present, the actual end-point of Applicants' compositions

may be higher by 20 degrees F or more than the 95 weight percent point.

The Differences Between the Claimed Invention and the Davis et al. Reference

Following the discussion of the Applicants' invention, it is now easier to explain the differences between Davis et al. and the claims in this case. These differences include the following:

- Davis et al. is not concerned with the toxicity of the compositions described in the reference and, consequently, does not teach any methods for lowering the toxicity of the diesel products produced by his process.
- Davis et al. fails to recognize that diesel fuels derived from Fischer-Tropsch products may have an end boiling point significantly above 700 degrees F which makes it possible to increase the amount of high boiling hydrocarbons in the fuel.
- All of the compositions described in Davis et al. would have a uni-modal boiling point profile. None of the compositions described in this reference would be expected to have a bi-modal boiling range profile.
- Those diesel compositions claimed by Applicants which display a uni-modal boiling range profile will have a lower dermal toxicity than the diesel fuels described in Davis et al.
- All of the compositions claimed by Applicants which display a uni-modal boiling profile will have a significantly higher 95 weight percent point and end boiling point than the diesel products described in Davis et al.

Davis et al. makes no mention of the toxicity of the products made using the process described in the reference, and, consequently, it contains no teaching about the toxicity of the 400-650 degree F boiling fraction or the beneficial properties of the high boiling hydrocarbons. Therefore, Davis et al.

provides no incentive for one skilled in the art to produce fuel compositions meeting the limitations of the fuels covered in Applicants' claims. As a result, none of the compositions taught in Davis et al. would be expected to display a bi-modal boiling profile, and none of the fuel compositions taught by the reference would contain significant amounts of hydrocarbons boiling above 700 degrees F.

Davis et al. fails to recognize that diesel fuels may be produced from Fischer-Tropsch derived hydrocarbons having significantly higher end boiling points than 700 degrees F. Davis et al. describes the jet produced by his process as having a boiling range (initial boiling point to end boiling point) of "320°/500° F" and his diesel as having a boiling range of "500°/700° F" (See column 3, line 42). In the description of the figure, Davis et al. in column, lines 65-67, describes the 320-700 degrees F fraction as the "useful product" which may be employed as diesel or jet fuel. The 700 degree F plus fraction is shown in the figure as being recycled to the hydroisomerization reactor where it is cracked into lower molecular weight products (see the figure and column 3, line 68 to column 4, line 2). The conversion of the 700 degree F plus fraction to lower boiling products is also described earlier in column 2 at lines 9-14. Thus Davis et al. does not teach that hydrocarbons boiling above 700 degrees F are useful in formulating diesel but rather Davis et al. recycles the heavy hydrocarbons to extinction. Accordingly Davis et al. specifically teaches away from the fuel compositions claimed by Applicants as part of the invention.

All of the jet and diesel fuels described in Davis et al., i.e., those products boiling between 320 and 700 degrees F, would be expected to have a uni-modal boiling profile because there is no incentive for one skilled in the art to remove the 400-650 degree F fraction. With an end boiling point of 700 degrees F and a uni-modal boiling profile, all of the fuel compositions of Davis et al. would be expected to have a mid boiling point of less than about 650 degrees F. Referring to figure 3 in Applicants' specification, it will be noted that Fischer-Tropsch derived compositions boiling in the range of jet and

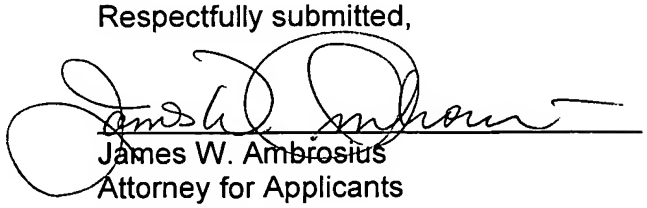
diesel which have a uni-modal boiling profile and a mid boiling point of about 650 degrees F or less display the highest level of dermal toxicity. In contrast to the compositions taught in Davis et al., the diesel fuels having a uni-modal boiling profile which are claimed by Applicants would contain significant amounts of hydrocarbons boiling above 700 degrees F which would of necessity also raise the mid boiling point.

The points made by Applicants for patentability of each of the independent claims in the instant application over Davis et al. may be summarized in the following manner.

- All of the fuel compositions covered by amended claim 1 have a significantly higher 95 weight percent boiling point than the jet and diesel compositions described in Davis et al.
- The fuel compositions covered by claim 31 all have reduced dermal toxicity while the compositions taught in Davis et al. would display significantly higher dermal toxicity.
- All of the fuel compositions covered by claim 35 have a bi-modal boiling point distribution while all of the jet and diesel compositions described in Davis et al. would have a uni-modal boiling point distribution.

It is respectfully submitted that all of the claims remaining in the case are directed to patentable subject matter, and allowance in due course is respectfully solicited.

Respectfully submitted,



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